1853MNRAS..14...35R

Professor Chevallier has forwarded to the Society several copies of a printed circular containing the above elements, accompanied by an ephemeris of the planet computed from them, and extending from December 27 to February 1, 1854. The circular also includes an ephemeris of Comet V. 1853, extending from December 25 to January 14, 1854, based on an orbit computed by the discoverer, M. Klinkerfues.

A copy of this circular may be obtained by any Fellow of the Society upon applying at the Apartments, Somerset House.

Observations of Euterpe. By R. C. Carrington, Esq.

REDHILL. Transit Circle.

	Green. M.T.	R.A.	N.P.D.	Log $\frac{q}{P}$
1853.	h m s	h m s	° ′ ″	
Nov. 18	11 18 22·1	3 9 18·11	74 26 34·0	9·7630
19	11 13 26·7	8 18·47	29 27·9	9·7635
21	11 3 38·5	6 21·72	35 6·7	9·7645
22	10 58 45·3	5 24·26	37 51·1	9·7650
23	10 53 53·0	3 4 27·79	40 30·5	9·7654
Dec. 1	10 15 38·6	2 57 39·56	74 58 21·9	9·7685
16	9 9 3·4	2 50 1·80	75 8 42·8	9·7704

Note on Comet III. 1853. By M. C. Rümker.

The phenomenon attending the setting of the comet of Klinkerfues, witnessed September 2, 1853, at Liverpool, Durham, Markree, in America, throughout Denmark, Sweden, and several parts of Germany, brings to recollection the appearance of the great comet of 1843. The tail of that comet first attracted the attention of European observers, some of whom never saw the nucleus; but the tail remained for several evenings visible; and on or about the 25th of March, after its setting in the south-west, a luminous appearance was observed above the western horizon and called a zodiacal light, the name of *Aurora occidentalis* being deemed objectionable.

On the 2d of September, 1853, at 9^h 15^m, or two hours after the setting of the comet of Klinkerfues, I observed at Hamburg, a little to the north of west, an appearance resembling that of the tail of a comet, slightly curved, with the concave side to the north.* But as the phenomenon, which appeared at first immovable, was a quarter of an hour afterwards seen to the south of *Arcturus*, when clouds prevented further observations, and as several observers have attributed it to the effects of the comet, I propose to in-

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* Dr. Ritter observed precisely the same phenomenon at Göttingen, where M. Klinkerfues had seen some days before the actual tail of the comet, curved in the same direction.

1853MNRAS..14...35R

vestigate how far this supposition can be justified by theory and reconciled with the coincidence of the alleged tail with the star *Arcturus.*

If the tail of the comet had no curvature, it should, as viewed from the earth, coincide with a great circle passing through the sun and comet; but the angle formed by this great circle with an arc joining the comet with *Arcturus* would be the geocentric effect of a curvature. Now it may be remarked, that the projection of this great circle upon the plane of the meridian must be represented by a straight line when its intersection with the equator crosses the horizon, but will, in the present case, where the right ascension of the sun is less, but its declination greater, than that of the comet, be curved previously to that time with its convex side to the north, and subsequently to the north pole. The calculation of the effect of curvature may then be based upon the geocentric place of the comet, derived from observation, by computing the angle at the comet in a triangle, in which the sun's and comet's polar distance and the intercepted angle, or the difference of their right ascensions, are given; and by subtracting from its supplement that angle at the comet contained between the arcs joining the comet with the pole and with *Arcturus*, the remainder is the geocentric effect of curvature, and will be found 28° 12′, assuming the right ascension of the comet to have been $11^h\ 22^m\ 29^s$, and its declination $= +\ 6°\ 54'$. It is found that the angular distance of the comet from the sun is 8° 51′, and from the star 42° 23′.

Although instances of greater curvatures are known, it may be worth while to ascertain the amount of the actual curvature, or the angle at the sun between two lines from the sun to the comet, and from the sun to that point in the comet's tail which, viewed from the earth, covered *Arcturus.* But, as physical causes can only be assigned for curvatures taking place in the plane of the comet's orbit, we shall imagine two great circles meeting in the geocentric place of the sun, and in the heliocentric place of the earth, the planes of which intersect each other in the produced radius vector of the earth. In the circumference of the *first* of these two great circles, the plane of which passes through the real comet, are its heliocentric and geocentric places, at the point where two lines from the sun and from the earth through the comet terminate. This circle coincides with the above, passing through the sun and comet, made use of in our former calculation. In the circumference of the plane of the *second* great circle passing through *Arcturus,* this star is at the same time the geocentric place of that point in the axis of the comet's tail, which appeared to us to cover it, whilst the intersection of this second great circle with the comet's orbit is the heliocentric place of this same point, and the arc of the comet's orbit intercepted between the first and second great circle is the actual curvature of the tail.

For the calculation we have, in addition to the above-stated observed place of the comet, the choice of more arguments than are required, which may serve to check the calculations. For my calcu-

1853MNRAS..14...35R

lation only two parts of the elements are introduced, viz. the comet's radius vector, which, so near the perihelion as well as the inclination, may be sufficiently relied on. I omit the calculation, which may be arranged differently. The geocentric effect of the curvature as well as the comet's angular distance from the sun and from *Arcturus*, resulting from this calculation, agree perfectly with what was found by the former proceeding. The actual curvature, or the angle at the sun between the comet and the point in question, I find = 22° 5′, and the absolute distance of this point from the earth I find 0·64947, which is all within the limits of probability, so that we need not hesitate to ascribe the beam of light seen first in the west and then in the south-west to the comet. But, in order to establish a connexion between the first apparition and ensuing phenomenon (zodiacal light or aurora borealis), we must follow the comet in the different positions of the first great circle with respect to the horizon of Hamburg, during the rotation of the earth; whence it becomes evident, that the point of its intersection with the equator sets in the true west, and that the amplitude of that point of the beam of light which crossed the horizon at $9^{h}\frac{1}{4}$ was 2° 58′ north of west. As long as the sun was between the comet and the lowest point of the great circle, elongated 90° from its intersection with the horizon, the beam was directed upwards; but after the comet's passing this point, the beam was directed downwards, and the phenomenon must disappear. It further follows that, under the above-mentioned circumstance of the sun's north polar distance being the lesser, the amplitude of the setting point of the beam must, until its disappearance below the horizon, have had a southerly motion, whilst the comet itself below the horizon was proceeding to the north. All this agrees perfectly with the observations in Hamburg and all other places, where, in general, the first phenomenon was seen more towards the south, where it was perceived later, setting aside anomalies arising from difference of latitude. At $9^{h}\ 15^{m}$ the

Sun's depression below the horizon of Hamburg was 19° 34′; azimuth N. 43° 46′ W.
Comet's — — — — — 16° 25′ — N. 52° 25′ W.

At 11 o'clock the depression of the comet was 26° 17′, and its azimuth N. 26° 38′ W., being then 1° above the sun. In more northerly latitudes the comet approached nearer the horizon, so that the apparition of its more expanded fan-like tail could, with the aid of increased darkness, produce a phenomenon similar to an aurora borealis. I beg leave to mention that Mr. Hartnup, as I understand, has called it an aurora borealis of unusual appearance. Towards two o'clock in the morning of September 29 an aurora borealis was seen at Durham. Bruhn's comet was then quite near the horizon, 36° perpendicular above the sun. I have further to impress that the comet of Klinkerfues was *in its perihelion*, and the comet of Bruhn's and the great comet of 1843 near it.

There is, however, one circumstance which is more difficult to reconcile with this hypothesis, that is its proper motion, differing from that of the fixed stars, and greater than could arise from its motion in its orbit. But, considering that the tail of a comet is a fluid which cannot be classed under what is generally termed heavenly bodies, its motion cannot be put to the mathematical test before its nature is better known. It is, moreover, well known that motion has been observed in the tails of several comets, and that it consists of rays which project in short intervals of time, considerably more or less, like those of an aurora borealis.

As these points appertain to physical astronomy, I must leave them to those who are better versed in that part of the science, and confine myself to the following remarks. The distance of the comet from the earth was too great to allow a contact of its expanded tail with the atmosphere of the earth. But, notwithstanding, the phenomenon might have been an atmospherical one caused by the tail of the comet, as there are perihelia round the sun and halos round the moon, rainbows, &c. &c., which expand and contract, and are generated in the atmosphere. And although there have been observed more auroræ boreales than comets, there certainly also exist more comets than those that have been discovered; and it has already been remarked by others, that our earth may often have been enveloped in the tail of a comet without our having been aware of it.

Extracts of a Letter from Professor C. Piazzi Smyth relative to Cometary Physics and to the Rating of Chronometers by Lunars.

"It is generally believed that the tails of comets are only put on near the perihelion point of their orbits; that they are produced by the intensity of the sun's rays there, and are dissipated on either side. Now I maintain that this is the reverse of what actually takes place. The comets have all the particles of their mass, whether tail, body, coma, &c., always with them; though in very different states of concentration at different times: and this it is which, combined with the greater or less intensity of solar illumination, according to their distance from the sun, and the greater or less angle under which they may be seen by reason of proximity to the earth, causes the variations in observed appearance. Moreover, it is now found that all comets, large and small, invariably become not only smaller, but more compressed and concentrated, as they approach the sun; and so far from a dissipation of solid matter, there is a bringing together of it, and a consequent brightening. The tail, indeed, shuts up like a many-draw telescope as it nears the perihelion, and opens out again as it leaves it. The amount of such concentration appears to vary in a proportion not yet accurately ascertained with the length of the radius vector or distance of the comet from the sun. So that, with such comets as Encke's and Biela's, where the difference of perihelion and aphelion distances is not very great, the amount of concentration is never considerable, and they are never